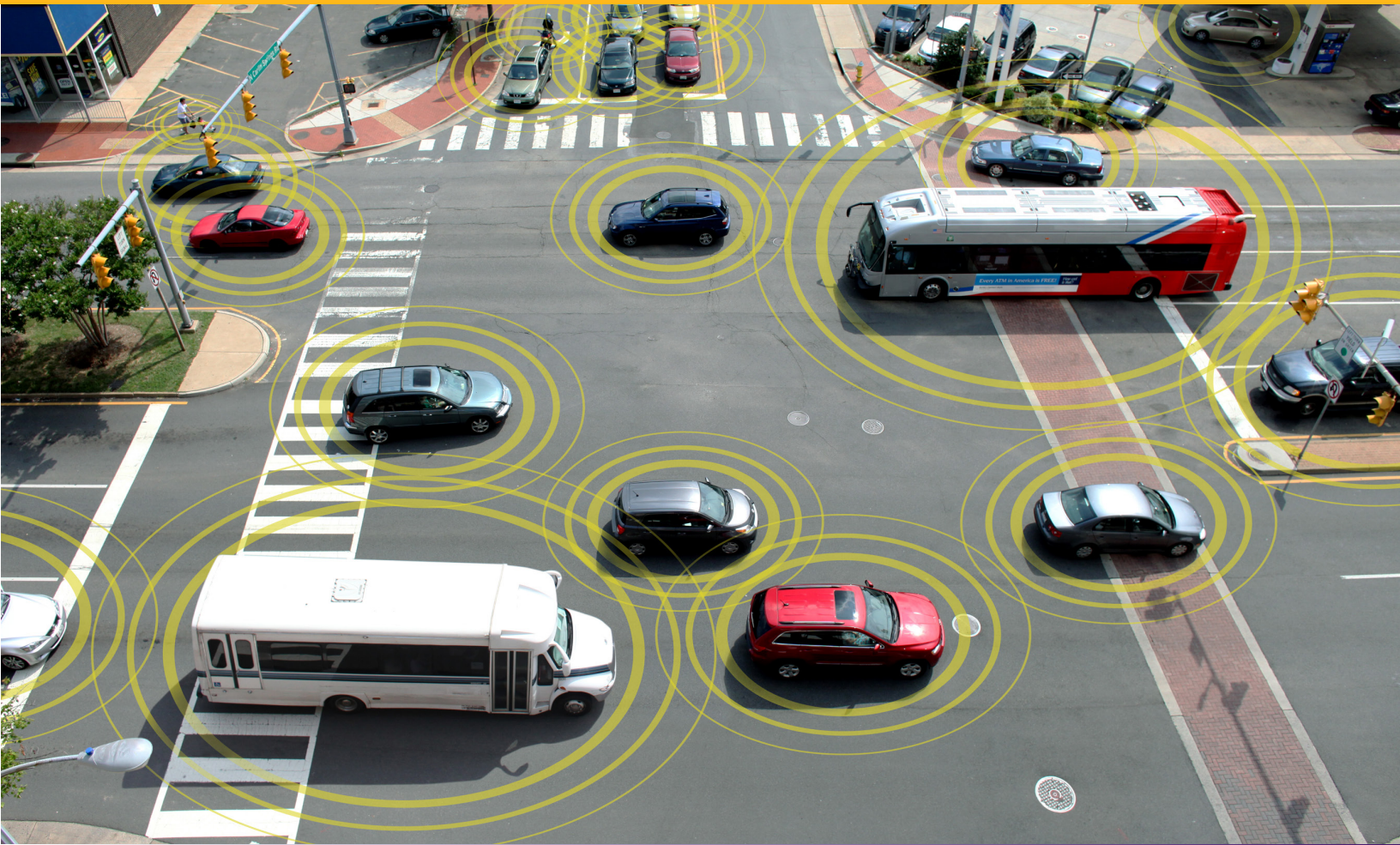




Connected Vehicle TEST BED

CONNECTED VEHICLE SYSTEMS | SAFETY, MOBILITY, & ENVIRONMENTAL APPLICATIONS | IN-VEHICLE DEVICES



SOUTHEAST MICHIGAN TEST BED RESOURCE GUIDE



U.S. Department of Transportation



Test Bed Overview

The United States Department of Transportation (USDOT) Intelligent Transportation System (ITS) Joint Programs Office (JPO) Connected Vehicle Test Bed in Oakland County, Michigan (known as the Southeast Michigan Test Bed) was implemented in 2007 to serve as the development and test facility for the Proof of Concept engineering project conducted by the USDOT and the auto industry to determine the feasibility and technical limitations of Dedicated Short Range Communications (DSRC) operating at the 5.9 GHz bandwidth. Over the past few years, the Southeast Michigan Test Bed has gone through numerous enhancements, including geographical expansion and technical and architectural updates, designed to support the connected vehicle industry’s evolving needs for a testing and development environment.

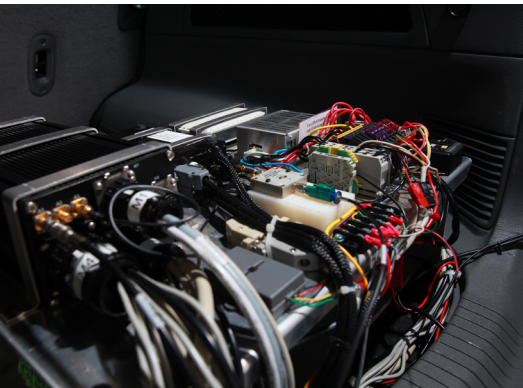
Thanks to feedback from the Connected Vehicle Test Bed user community, the Test Bed has undergone upgrades and enhancements to support the evolving needs of its users. The revised (upgraded) Southeast Michigan Test Bed started with a set of planned minor updates and subsequently grew to include serving as a reference platform for staging demonstrations at ITS World Congress in September 2014. The upgrades may extend to other connected vehicle research test and development environments in Michigan if they are successful. In the interim, these upgrades provide an enhanced platform that can be used to test several new capabilities that will be needed for more extensive deployment pilots in 2015 and 2016.

Developers and manufacturers are actively being sought by the connected vehicle research community to develop, test and demonstrate advances in the technology. The Southeast Michigan Test Bed will help fill in the missing pieces required to run a fully operable and stable connected vehicle environment. Developers are encouraged to advance and refine the technologies to make them function better and make them easier to implement.



Map of Southeast Michigan Test Bed RSU locations. Approximately 50 RSUs have been deployed.

Test Bed Resources



The Southeast Michigan Test Bed is a Federally-funded resource available to developers to test how connected vehicle technologies will perform under real-world operating conditions. The Test Bed provides cutting-edge technology for users to test a variety of connected vehicle applications, concepts, and equipment, including connected vehicle infrastructure and components; safety, mobility, and environmental applications; in-vehicle devices; and security system operations. Test Bed resources are available to users at no cost for use on-site, on temporary loan, or as part of a no-cost subscription, eliminating user-incurred expenses in developing duplicative tools while ensuring consistency and interoperability.

Test Bed Products and Services

Roadside Units (RSUs) and After Market Safety Devices (ASDs)	<ul style="list-style-type: none">Enhanced Safety Pilot generation or betterMultiple vendor products availableAll QPL certified
RSU Monitoring System (RMS)	<ul style="list-style-type: none">RSU health monitoring systemConsistent monitoring capability across all deployed RSUsConsistent analysis across all subscribed test beds
RSU Coverage Tool	<ul style="list-style-type: none">Generates Google Earth Plots of DSRC messages by message type, RSU, and Receive Signal Strength
Data Management System (DMS)	<ul style="list-style-type: none">Captures and redistributes data received by RSUsAccess to data from multiple test beds
Security Credential Management System (SCMS)	<ul style="list-style-type: none">SCMS manages the certificates utilized in connected vehicle applications. Affiliated test beds can enable and test security without the overhead of developing and maintaining their own credential system.
SAE and FHWA message formats for Signal Phase and Timing (SPaT) and Map SPaT Listener	<ul style="list-style-type: none">Broadcasts both SAE and FHWA SPaT & Map message formatsDecodes and displays relevant SPaT information for both the SAE and FHWA message formatsBoth message formats supported in a single tool
RSU Trailers	<ul style="list-style-type: none">3 Portable, solar powered trailers for temporary RSU installationsProvides temporary RSU access for critical application testing
Vehicles	<ul style="list-style-type: none">9 vehicles equipped with DSRC/GPS antennasMounting location with easy access to power for DSRC-enabled devices
Portable Spectrum Analyzer (Coming Soon)	<ul style="list-style-type: none">Enables RF spectrum analysis for RSU implementation site surveys
Reference Network Architecture Implementation	<ul style="list-style-type: none">A reference implementation of RSUs connected via multiple network technologies
Staff Resources with Unmatched Connected Vehicle Experience	<ul style="list-style-type: none">40 years of cumulative connected vehicle experienceExpert guidance for any connected vehicle project



Test Bed Operational Environment

Key concepts that define the overall design of the test bed include:

- Test Bed Geographic Reference
- Privacy by Design
- Data Context
- Data Bundles
- Data Exchange Pattern

These concepts are described in more detail below.

Test Bed Geographic Reference

The initial Situation Data Warehouse located in the Test Bed is defined by the the 2x3 degree geographic region shown below. It is overlaid by a geographic grid of “tiles”, each of which is a 10-millidegree square. This yields 60,000 identically sized and shaped tiles, which are defined by a pair of geo reference points for the NW and SE corners of the tile.

As more data providers come online, the Test Bed service area could be further divided into 1 degree regions to support the greater granularity needed for the increased data volumes. This process of subdivision could be iterated to scale as necessary to support increased data volumes.



Southeast Michigan Test Bed Geographic Boundaries
(Source: Google Earth)



Privacy by Design

The entire Southeast Michigan project is being designed around the principle that the system needs to maintain the privacy of the driver and ensure that individual automobiles cannot be tracked through the system any more than by an observer on the side of the road. As a result, every data transmission is either signed or encrypted to preserve privacy, using the Security Credential Management System. The requirement for signed and encrypted messages was the first requirement identified for the system and has carried through to both design and implementation.

Data Context

The data context is the metadata, or the data about the data. Within a Connected Vehicle environment, there is a significant amount of data potentially available; however, without knowing the context of that data – when, where, why, and how – that data is worthless. For example, a data point about speed is meaningless without context about when and where that data point was generated. With those three elements – speed, location and time – applications can be developed to evaluate traffic flow, traffic signal timing, or other uses.

Within the Test Bed, data is collected and distributed in bundles to provide as much context as possible for the users of that data. Vehicle Situation Data messages (VehSitDat) combine multiple Basic Safety Messages (BSM) into one bundle both to reduce network traffic and to provide additional context regarding the data to the user.

Data Bundles

For efficiency of bandwidth and expediency, individual data objects of the same type/classification are often aggregated into a single data construct called a bundle. The type/classification of the bundle contents are included as metadata in the encompassing Application Protocol Data Unit (APDU) to facilitate processing and circumvent the need to examine the bundle contents. As part of the architecture implemented in Southeast Michigan, multiple data bundles have been defined, tested and implemented. Additionally, multiple vendors, from hardware and software developers to research institutions, have worked to create, test and implement these data bundles. An example bundle is shown in the figure to the right. Contents of the bundle are tailored for each information flow.



Photo courtesy of USDOT

Header Segment		1609.2 Header	
		APDU Type= (see table below)	
		Body Length	
		Bundle Generation Time	
		Bundle Generation Location	
		Total Bundle Count	
Body Seg.	SAE J2735 EVSM 1	Safety Pilot BSM	Other Data Elements
	SAE J2735 EVSM 2	Safety Pilot BSM	Other Data Elements
	SAE J2735 EVSM 3	Safety Pilot BSM	Other Data Elements
	SAE J2735 EVSM 4	Safety Pilot BSM	Other Data Elements
	SAE J2735 EVSM 5	Safety Pilot BSM	Other Data Elements
	SAE J2735 EVSM 6	Safety Pilot BSM	Other Data Elements
	SAE J2735 EVSM 7	Safety Pilot BSM	Other Data Elements
	SAE J2735 EVSM 8	Safety Pilot BSM	Other Data Elements
		1609.2 Header	

Example data bundle produced by the test bed data warehouse



Data Exchange Pattern

A significant number of information flows between various Test Bed objects are characterized as “peer to peer” data exchanges. All such information flows are developed using the following four-stage message exchange pattern as a basis. All third party objects that interact with Test Bed objects are required to follow the specific instantiation of this pattern as defined for the specific information flow.

- 1. **Service Awareness** – As new objects are introduced into the Test Bed (e.g., a connected vehicle entering the Test Bed area), they become aware of other objects with which they might want to exchange data. This awareness must include sufficient information to allow the “newbie” object to determine where to reach out to for any services that are available.
- 2. **Trust Establishment** – All participant objects in the Test Bed must have valid Security Credential Management System (SCMS) credentials as necessary to support active data exchange.
- 3. **Data Exchange** – Upon the establishment of trust, data bundles are exchanged between the initiating object (typically a vehicle) and the service (or multiple services). Data may be exchanged multiple times within a data exchange session depending on the application and the request.
- 4. **Nonrepudiation** – Following the data exchange, this final phase of the Data Exchange sequence is used to confirm receipt of the data bundle, provide proof of the integrity and origin of the data bundle, and authenticate that the data bundle received is genuine.

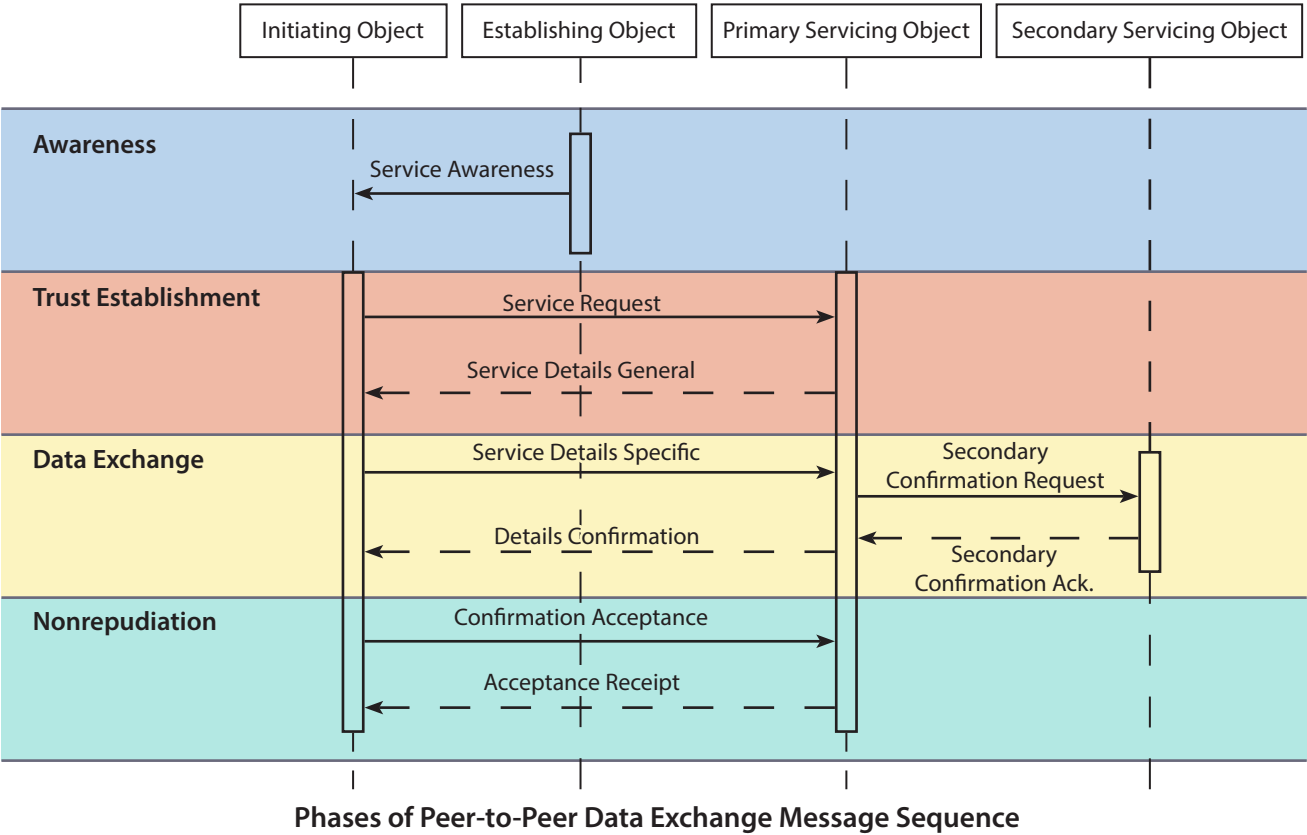
Test Bed Architecture

The architecture for the Southeast Michigan Test Bed project was developed using the framework and tools of the Connected Vehicle Reference Implementation Architecture (CVRIA) developed by USDOT (<http://www.standards.its.dot.gov/DevelopmentActivities/CVReference>). The CVRIA defines the systems and interfaces between systems that deliver services and applications within the connected vehicle environment. Specifically, CVRIA identifies interfaces that require new or modified ITS standards to support the connected vehicle environment and develops a strategy for prioritizing development of those standards. The connected vehicle environment includes vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I), and interfaces with other mobile devices, i.e., “V2X” interfaces.

The development of the Southeast Michigan Architecture has evolved significantly since its inception based on lessons learned from the development and showcasing of the architecture as well as the implementation of various components to facilitate implementation and long-term growth and use of the system. The architecture has been designed to be secure and accessible to a wide range of users, including the traveler – often multi-modal – and commercial and transportation providers and authorities. In addition, it is flexible enough to support additional test beds throughout the country by providing a common platform that permits those facilities to focus their resources on testing and developing applications and systems that are relevant to those test beds. The Michigan DOT, City of Detroit, and California DOT (Caltrans) are currently applying the architecture to connected vehicle deployments in their regions.

Architecture Data Flows

There are multiple data flows and interfaces within the Southeast Michigan Test Bed 2014 project architecture. As defined for the architecture, data flow security encompasses three categories: Legacy, Trusted, and Trusted Confidential. Each of these flows needs to be evaluated for the required level of security.



Data Flow Description		Data Flow Example
Legacy	Data flows that already exist amongst devices, systems or components. Legacy data flows are already defined and may be proprietary. These data flows are not secured using Test Bed mechanisms, but may be secured using legacy methods depending on the systems involved (e.g., encrypted VPN between center and field device, or privately owned and physically secured communications components).	The connection between a traffic signal system and the central server that operates or monitors the traffic signal system.
Trusted	Data flows that are signed but not encrypted using credentials supplied by the Test Bed's security service. Trusted data flows are necessary to ensure the integrity and authenticity of messages exchanged between two entities, especially where one entity is expected to “act” based on the message received from the other entity.	SPaT message broadcast from the RSU to the receiving on-board equipment (OBE). Potential action by the OBE would be to notify the driver of signal change information, so that ultimately the driver could modify the vehicle trajectory appropriately.
Trusted Confidential	Data flows that are signed and encrypted by the sender and can only be decrypted by the intended recipient. Trusted confidential data flows are necessary in a peer-to-peer data exchange where the exchange of information may include information that needs to be kept secure from third parties.	Peer-to-peer data exchanges between the vehicle and a financial management/processing system for a tolling application.



Architecture Views

The CVRIA is developed in multiple views. Two of these views for the Southeast Michigan Test Bed Architecture – Physical and Enterprise – are illustrated on the following pages.

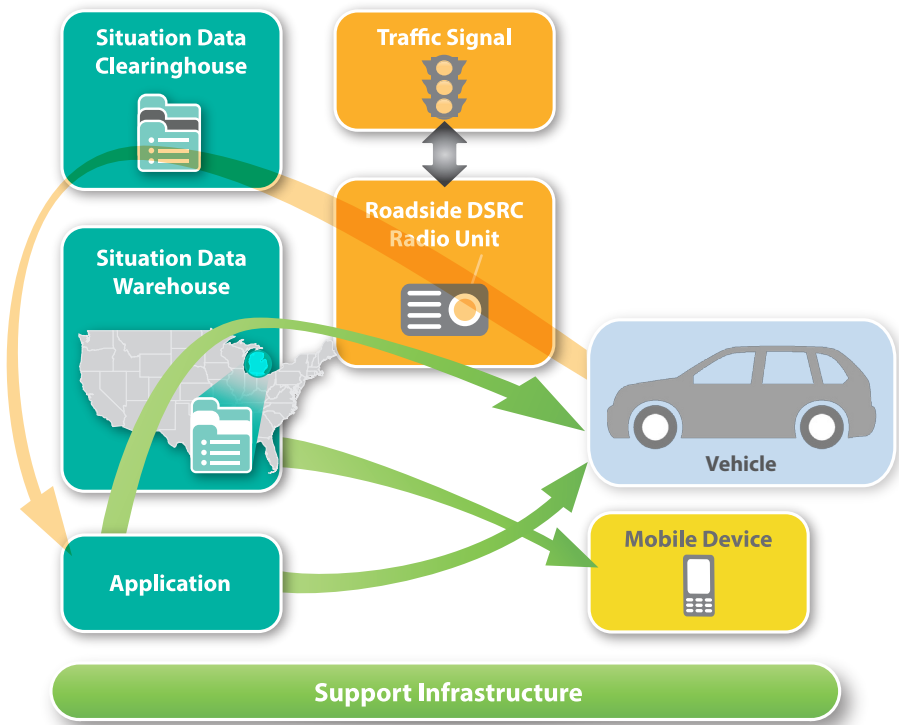
The **Physical View** describes the physical objects (systems and devices) and their application objects, which define more specifically the functionality and interfaces that are required to support a particular connected vehicle application. The physical view also describes the information flows that depict the exchange of information between physical objects and application objects.

The **Enterprise View** describes the relationships between organizations and the roles those organizations play within the connected vehicle environment, including installing, operating, maintaining, and certifying all the physical objects within the connected vehicle environment. The enterprise view facilitates understanding of the “human” pieces of the Test Bed system and their strong relationship to the technical details of the physical components.

The detailed Physical and Enterprise views of the Southeast Michigan Tet Bed Architecture are depicted on the following pages, followed by a description of the components that are illustrated in each view.

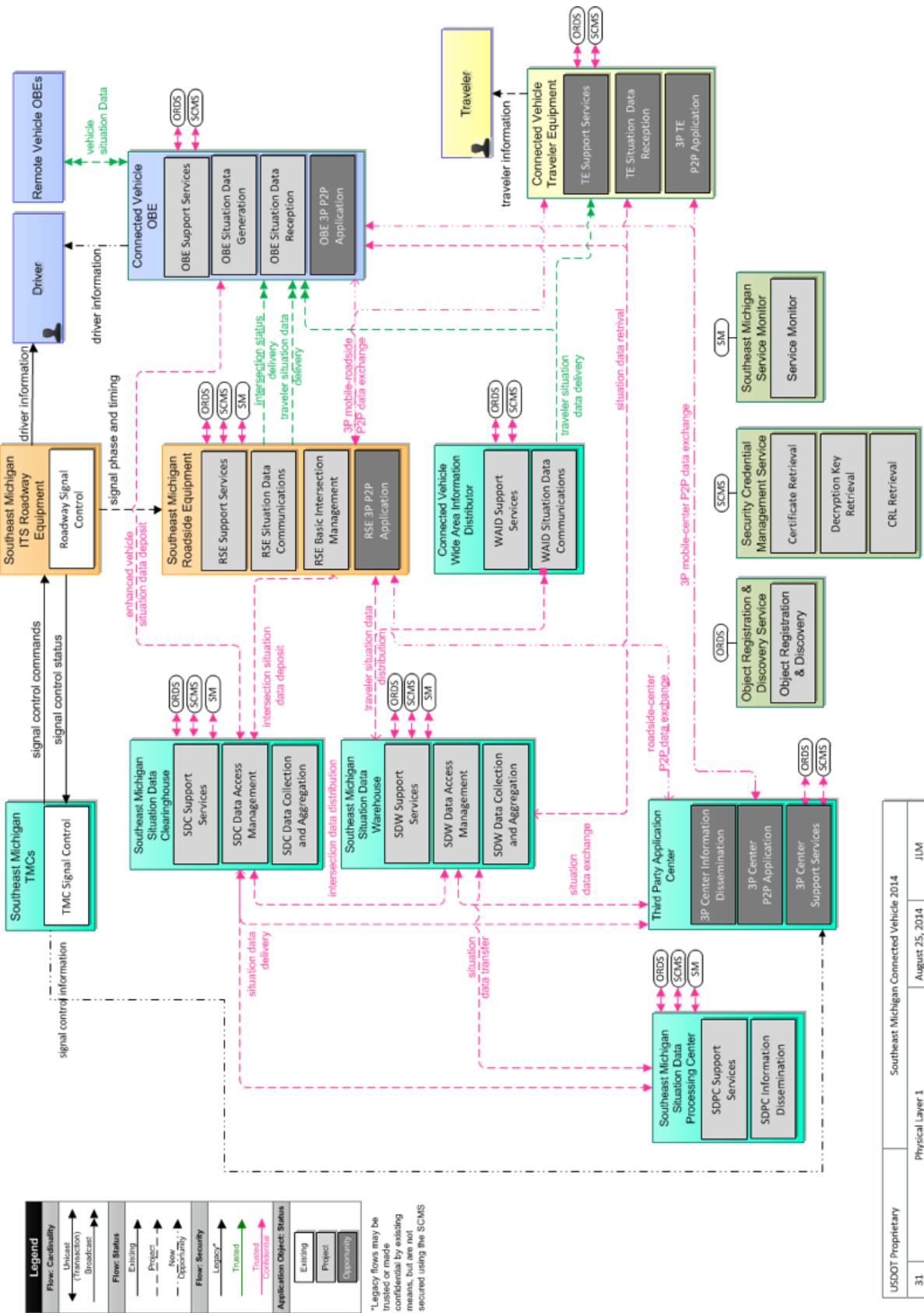
The components of the Test Bed architecture are categorized by their background color:

- Vehicular (blue)
- Roadside Equipment (orange)
- Support Services (green)
- Center Based (cyan)
- Traveler (yellow)



High-level Overview of the Southeast Michigan Test Bed Physical Architecture

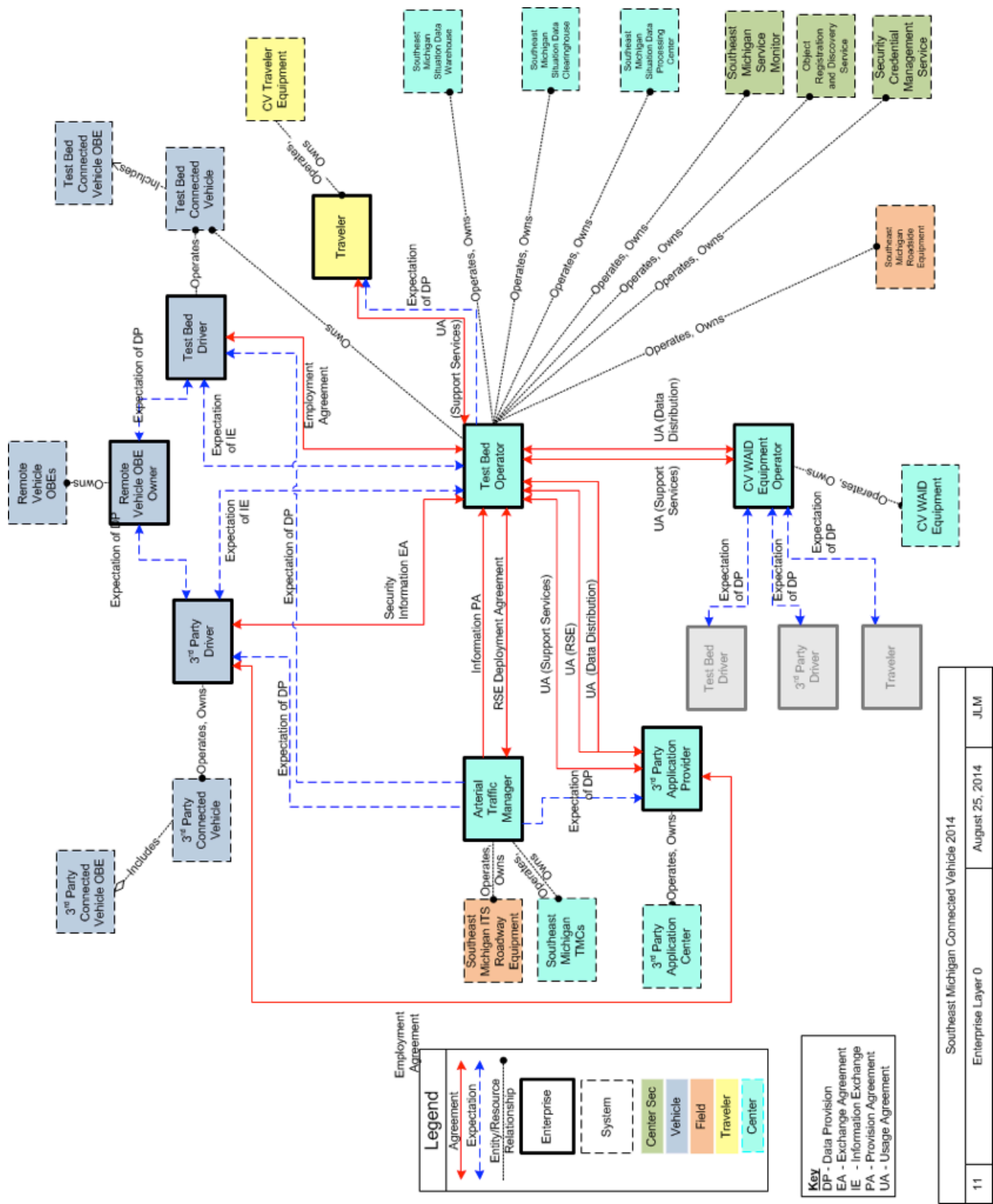
Southeast Michigan Test Bed Physical Architecture (Layer 1)



Test Bed Physical Components

Vehicular	Connected Vehicle On-Board Equipment (OBE)	<p>The connected vehicle OBE represents on-board devices that provide the vehicle-based processing, storage, and communications functions necessary to support connected vehicle operations. It is a custom version of the CVRIA “Vehicle OBE” object. The radio(s) supporting V2V and V2I communications are a key component of the connected vehicle OBE. This communication platform for the vehicle is supported by processing and data storage capabilities in the OBE that provide the basic communications functions and higher level connected vehicle applications.</p> <p>The Connected Vehicle OBE interfaces to other on-board systems through a vehicle bus (e.g., CAN). Represented in CVRIA as the Vehicle Platform, this interface provides access to on-board sensors, monitoring and control systems, and information systems that support connected vehicle applications. In addition to the vehicle bus interface, the connected vehicle OBE also provides an interface to a location data source. Finally, a driver interface is included that supports visual, audio, and haptic interaction with the driver.</p> <p>In CVRIA, the Vehicle OBE includes the functions and interfaces that support CV applications for passenger cars and trucks. Many of these applications (e.g., V2V Safety applications) apply to all vehicle types, including personal automobiles, commercial vehicles, emergency vehicles, transit vehicles, and maintenance vehicles. In CVRIA, the OBE is used to model the common interfaces and functions that apply to all of these vehicle types.</p>
	Remote Vehicle OBEs	<p>Remote Vehicle OBEs represent other connected vehicles that are communicating with the host vehicle. In CVRIA, this object provides a source and destination for information transfers between connected vehicles. The host vehicle OBE, represented by the Vehicle OBE physical object, sends information to and receives information from the Remote Vehicle OBEs to model all V2V communications.</p>
	Driver	<p>The Driver represents the person that operates a licensed vehicle on the roadway. Included are operators of private, transit, commercial, and emergency vehicles where the interactions are not particular to the type of vehicle (i.e., interactions supporting vehicle safety applications). Thus, the Driver originates driver requests and receives driver information that reflects the interactions which might be useful to all drivers, regardless of vehicle classification. The Driver also supports interactions for mobility applications that are primarily intended for drivers of private passenger vehicles. Information and interactions which are unique to drivers of a specific vehicle type (e.g., fleet interactions with transit, commercial, or electric vehicle drivers) are covered by separate objects.</p>
Roadside Equipment	Roadside Equipment	<p>The Roadside Equipment represents the Southeast Michigan Test Bed connected vehicle roadside devices that are used to send messages to, and receive messages from, nearby vehicles using DSRC. Communications with adjacent ITS Roadway Equipment and back office centers that monitor and control the roadside equipment are also supported. This device operates from a fixed position and may be permanently deployed or serve as a portable device that is located temporarily in the vicinity of a traffic incident, road construction, or a special event. It includes a processor, data storage, and communications capabilities that support secure communications with passing vehicles, other RSUs, and centers that provide back office support.</p>
	ITS Roadway Equipment	<p>ITS Roadway Equipment is distributed on and along the roadway of the Southeast Michigan Test Bed. The equipment monitors and controls traffic and the roadway itself. “ITS Roadway Equipment” represents all of the other ITS field equipment that interface with and support the Southeast Michigan RSUs, including traffic detectors, environmental sensors, traffic signals, highway advisory radios, dynamic message signs, CCTV cameras and video image processing systems, grade crossing warning systems, and ramp metering systems. Lane management systems and barrier systems that control access to transportation infrastructure such as roadways, bridges, and tunnels are also included. ITS Roadway Equipment also provide environmental monitoring, including sensors that measure road conditions, surface weather, and vehicle emissions. Work zone systems such as work zone surveillance, traffic control, driver warning, and work crew safety systems are also included.</p>

Support Services	Object Registration and Discovery Service	<p>Many of the services offered by roadside or center-based service providers operating within the Southeast Michigan Test Bed geographic boundary will require an advertisement of their existence and cyber location to potential user. Potential users consist primarily of Test Bed vehicles, but could include roadside or other center-based services. The Object Registration and Discovery Service will facilitate the registration of services by the respective service providers and the subsequent query-based discovery of these registered services. Center-based services operating outside of the Southeast Michigan Test Bed geographic boundary are not allowed to register.</p>
	Security Credential Management System (SCMS)	<p>The SCMS manages the distribution (both initial provisioning and refresh) and revocation of digital credentials used by connected vehicle objects to authenticate and preserve the integrity of information they exchange. The SCMS was developed primarily based on the SCMS Design for the USDOT Safety Pilot Model Deployment, without radical changes. Newly added information flows are for transactions in the trust establishment and nonrepudiation stages. It is assumed that the Test Bed object that is interested in requesting SCMS service has completed bootstrapping and possessed required key pairs and certificates for the transaction listed in the following sections.</p>
	Service Monitor	<p>The Service Monitor provides for the health and status monitoring and performance reporting of test bed objects, including SEMI-managed OBEs, RSU and all center systems.</p>
Center Based	Southeast Michigan Traffic Management Center (TMC)	<p>The Southeast Michigan TMC is a center-based ITS where traffic related data is typically stored and processed, roadway video collected and analyzed, and decisions made about transportation operations. For the Test Bed, the TMC is the host of the roadway signal control systems that operate selected traffic signal systems within the Test Bed. The characteristics of the selected traffic systems vary by brand/manufacturer/developer and by configuration (centralized, distributed or local control). Within the Southeast Michigan Test Bed, multiple control systems are in place and will be available for testing and development purposes.</p>
	Southeast Michigan Situation Data Clearinghouse (SDC)	<p>The SDC is a Transportation Information Center that provides data collection and repacking functions, but only for data that is relevant in the immediate future. Data deposited at the warehouse is immediately delivered (“pushed”) to all registered and available delivery locations.</p>
	Southeast Michigan Situation Data Warehouse	<p>The Southeast Michigan Situation Data Warehouse is a Transportation Information Center that provides data collection, fusing and repacking functions. Examples of data handled by this warehouse are speed limits, traffic signal locations and road restrictions. Data deposited at the warehouse are retained for a variable amount of time (based on the time context of the data) and are available for ad-hoc (“pull”) queries.</p>
	Southeast Michigan Data Processing Center	<p>The Situation Data Processing Center monitors and controls traffic and the road network. It represents centers that manage a broad range of transportation facilities, including freeway systems, rural and suburban highway systems, and urban and suburban traffic control systems. It communicates with Southeast Michigan ITS Roadway Equipment and Southeast Michigan roadside equipment to monitor and manage traffic flow and monitor the condition of the roadway, surrounding environmental conditions, and field equipment status. It manages traffic and transportation resources to support allied agencies in responding to and recovering from incidents, ranging from minor to major.</p>
Traveler	Third Party Application Center	<p>The Third Party Application Center represents the private infrastructure used to develop, maintain and/or host third party applications.</p>
	Connected Vehicle Traveler Equipment	<p>The Connected Vehicle Traveler Equipment consists of devices that are not integrated or embedded into the vehicle. This may include portable DSRC equipment, smart phones or tablets working through the cellular network for data transmission, or HD radio-type systems and satellite-based systems that have a data transfer component. These devices are typically used to acquire information from the Situation Data Warehouse.</p>



Test Bed Physical Components

Vehicular	Remote Vehicle OBE Owner	Remove Vehicle Drivers (or Remote Mobile Device Operators) include the operators of any other vehicle or mobile device equipped with the enabling technologies and possessing valid security credentials which allow connected vehicle operations within the Southeast Michigan Test Bed. This is an essentially artificial distinction created to better illustrate the relationship between connected vehicle equipped vehicles.
	Test Bed Driver	Drivers (or Mobile Device Operators) include the operators of any vehicle or mobile device equipped with the enabling technologies and possessing valid security credentials which allow connected vehicle operations within the Southeast Michigan Test Bed. Non-motorized mobile device operators (pedestrians and cyclists) have different operating characteristics and needs than motorized mobile device operators. Test Bed drivers operate Test Bed connected vehicles and have an employment agreement with the Test Bed Operator.
	Third Party Driver	Drivers (or Mobile Device Operators) include the operators of any vehicle or mobile device equipped with the enabling technologies and possessing valid security credentials which allow connected vehicle operations within the Southeast Michigan Test Bed. Non-motorized mobile device operators (pedestrians and cyclists) have different operating characteristics and needs than motorized mobile device operators.
Center Based	Arterial Traffic Manager	An entity responsible for the management of arterial traffic in the Southeast Michigan Test Bed geographic region.
	Test Bed Operator	<p>The Test Bed Operator provides operational and technical support for the Southeast Michigan Test Bed systems and components. This includes operational, technical and management of deployed RSUs units, Test Bed vehicles, Data Warehouses and other infrastructure services and platforms, the supporting communications, security and management services and infrastructure.</p> <ul style="list-style-type: none">Owns and operates the Object Registration and Discovery Service. Facilitates and maintains an Expectation of information exchange with other Test Bed Entities.Owns and operates the SCMS. Facilitates and maintains an associated Security Information Exchange Agreement with other Test Bed Entities.Owns and operates the Southeast Michigan Situation Data Clearinghouse. Facilitates and maintains an Information Provision Agreement with other Test Bed Entities.Owns and operates the Southeast Michigan Situation Data Warehouse. Facilitates and maintains an Information Provision Agreement with other Test Bed Entities.
	Third Party Application Provider	Application Providers are specified more by role than by function. Providers are responsible for the development of the third party application, including initial creation, enhancement and bug fixes.
Traveler	Traveler	The Traveler represents any individual who uses transportation services. The interfaces to the traveler provide general pre-trip and en-route information supporting trip planning, personal guidance, and requests for assistance in an emergency that are relevant to all transportation system users. It also represents users of a public transportation system and addresses interfaces these users have within a transit vehicle or at transit facilities such as roadside stops and transit centers.

Security Credential Management System (SCMS) Availability Guidance

In a connected environment, it is crucial that a receiving device can rely on the authenticity and integrity of the messages it receives, particularly when these messages are used as an input to critical safety applications. This drives the need for a “trusted” backend credential system that can provide a way for vehicles to verify that the sender is authorized and that messages have not been tampered with between transmission and reception. The Vehicle Safety Communications 3 (VSC3) Consortium has proposed the design of a central Security Credential Management System (SCMS) to address these concerns, and the National Highway Traffic Safety Administration (NHTSA) has recently defined the components and functionality of the SCMS.

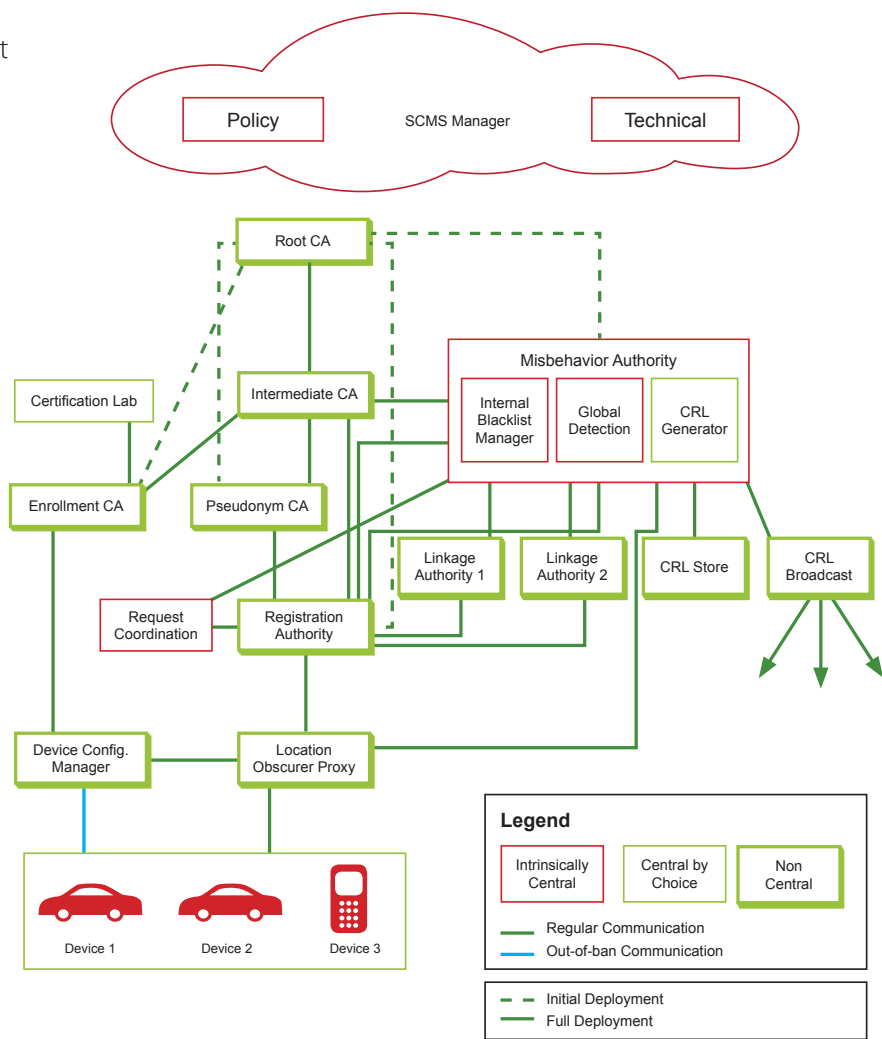
SCMS functions include pseudonym functions and bootstrapping functions.

Pseudonym Functions. Pseudonym functions include the creation, management, distribution, monitoring, and revocation of short-term certificates for vehicle OBEs. These certificates are used to sign BSMs prior to transmission so the receiver can determine if the transmitter is authorized and ensure the integrity of the signed message. The receiving device must also verify that the credentials of the transmitter have not expired or been placed on a global revocation list, which is managed and distributed by the SCMS. Pseudonym certificates are changed on a regular basis in order to protect the end user’s privacy.

Bootstrapping Functions. Bootstrapping functions establish a connection between vehicle OBEs and the SMCS, which includes assigning a long-term enrollment certificate to the OBEs. Certificates can be issued to specific OBEs or production lots of OBEs. Future NHTSA guidelines will determine when in the design process bootstrapping should take place.

The figure to the right depicts NHTSA’s proposed SCMS design for V2V. For more information on the individual components illustrated in the design, read the NHTSA report on “Vehicle-to-Vehicle Communications: Readiness of V2V Technology for Application.”

Current V2V Security System Design for Deployment and Operations
(Source: NHTSA)



Source: National Highway Traffic Safety Administration, Vehicle-to-Vehicle Communications: Readiness of V2V Technology for Application, Aug 2014.

Affiliation of Test Beds

The USDOT has organized an affiliation of 5.9GHz DSRC infrastructure device makers, operators of vehicle-to-infrastructure (V2I) installations, and developers of applications that use V2I communications. The affiliation facilitates information exchange, shares USDOT tools and resources, and encourages the consistent development and deployment of connected vehicle infrastructure components. Affiliation will help ensure that all future connected vehicle applications are based on common implementations of the communications technology, while harnessing the collective abilities of the membership. Organizations can become members of the Affiliation of Test Beds by signing the Affiliated Test Bed Memorandum of Agreement (see http://www.its.dot.gov/testbed/testbed_affiliated.htm).



Visit the Test Bed!

- | | |
|--------|---|
| STEP 1 | ARRANGE a site visit or tour of the Test Bed by contacting the Connected Vehicle Operations Chief: Jeremy Durst.
Telephone: 248.374.5098
E-mail: jeremy.s.durst@leidos.com |
| STEP 2 | OBTAIN test plan requirements and usage forms by contacting the Connected Vehicle Test Bed User Services Manager: Gary Golembiewski.
Telephone: 703.318-4769
Email: gary.a.golembiewski@leidos.com |
| STEP 3 | PREPARE a test plan and complete usage forms. |
| STEP 4 | SUBMIT the usage forms and test plan to the Connected Vehicle Test Bed User Services Manager, Gary Golembiewski. |
| STEP 5 | SCHEDULE testing! |
| STEP 6 | TEST! |

SOUTHEAST MICHIGAN TEST BED

For More Information

- **Southeast Michigan Connected Vehicle Test Bed**
www.its.dot.gov/testbed/testbed_SEmichigan.htm
- **Connected Vehicle Affiliated Test Beds**
http://www.its.dot.gov/testbed/testbed_affiliated.htm
- **USDOT Connected Vehicle Pilots Deployment Project**
<http://www.its.dot.gov/pilots/index.htm>
- **NHTSA Advance Notice of Proposed Rulemaking to Begin Implementation of Vehicle-to-Vehicle Communications Technology**
<http://www.nhtsa.gov/About+NHTSA/Press+Releases/NHTSA-issues-advanced-notice-of-proposed-rulemaking-on-V2V-communications>
- **Connected Vehicle Reference Implementation Architecture**
www.standards.its.dot.gov/DevelopmentActivities/CVReference



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